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The Cornucopia Project

The Montana Food System:
FIRST LESSONS IN SUSTAINABILITY

A study of the food system of Montana by
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1.0 INTRODUCTION

This paper reports the results of a three month study of Montana's food system conducted with the support of the Cornucopia Project of Rodale Press.

The primary goal of this study was to identify the fundamental components of the Montana food system and to diagnose their sustainability. The Montana food system - like the larger U.S. food system of which it is an integral part - has serious problems which threaten its long-term sustainability.

Another goal of the study was to compile an inventory of the different foods produced, imported and consumed in the state.

The study's third objective was to identify actions that can be taken by producers and consumers, state and local governments, business and industry to promote the development of a more stable food system.

Finally, the study strove to demonstrate the need for a thorough understanding of the food system and for careful planning of its future. This study is certainly not the last word on Montana's food system. It may well be the first word. During my research, I discovered no complete study of Montana's food system. All the information necessary for such a study is not available. Therefore the present report can only be a rough sketch of the more complete portrait that yet needs to be

drawn of our food system. If all this paper does is to demonstrate the need for such research, then it will have fulfilled its ultimate purpose.

That a better picture of our food system does not exist attests, in part, to the incredible productiveness of Montana's - and America's - agriculture in the last four decades. But studies such as those sponsored by the Cornucopia Project have begun to reveal that all is not well in the U.S. food system.(1) While the U.S. food system is not about to collapse by any means, supply disruption, dramatic price surges and crisis are definite possibilities.

Even a few statistics indicate the importance of the food system to Montana and hint at the disruptions that will result in the state in response to disruptions in the food system:

*Total food expenditures in Montana in 1979 were approximately $1 billion or $1,330 per capita.(2)

*Agriculture, the state's largest industry, had assets over $18 billion in 1981(3) and a gross income over $1.5 billion.(4)

*One-fourth of Montana workers are employed by the food system. At least 71,307 workers earned $455 million in 1980.(5)

The Cornucopia Project exists to encourage the development of a stable and sustainable food system. Presently the national food system is heavily dependent upon the input of non-renewable resources. It uses large quantities of fossil fuels, consumes ground water faster than it can be replenished, mines the topsoil with erosion-prone agricultural practices and squanders valuable organic matter through incomplete recycling. In the long-run these practices are not sustainable and no society dependent upon them can long ensure its own stability and progress.

This study found that Montana shares some, but not all, of the problems of the larger U.S. food system. In addition, our state's food system will encounter in the years ahead pressures that are uniquely its own.

2.0 WHAT IS A FOOD SYSTEM?

The food system is the entire process whereby a society obtains, maintains and ensures the nutrition of its members. "The food system is that segment of our economy that deals directly or indirectly with food products."(6) It is a flow, "an intricately woven pattern of many disciplines and occupations encompassing far more than farming",(7) a continuous interaction among the entire collection of industries, laws and attitudes that are concerned with the most essential of human activities: the procurement of food. Quite simply the food system is how we feed ourselves.

The food system may be best analyzed as a system of other systems that overlap and interact. The component systems are:

-The Production System: This includes agriculture and the agricultural support industries - seed suppliers, fertilizer manufacturers, equipment manufacturers, etc.

-The Transportation System: Agricultural products have to be transported from the farm to processors, from processors to distributors, from distributors to consumers.

-The Energy System: Our food system is highly energy intensive; it consumes a significant share of the national and state energy budget. Energy runs the production system, fuels the transportation system, operates the processing and distribution systems - and cooks our food.

-The Water System: Irrigation, the largest user of water in the food system, is also the largest source of water consumption in the nation. Water is also important in transporting, processing and preparing food. Finally it is used in the disposal of food and human wastes.

-The Processing System: This system collects, warehouses, mills, slaughters, prepares, packages the raw agricultural product into a form usuable by the distribution system. Most food in the U.S. undergoes some form of processing before it reaches the consumer.

-The Distribution System: This includes all the processes whereby food is delivered into the hands of the consumer: grocery stores, restaurants, cafeterias, even vending machines.

-The Home Food System: This system encompasses all the activities involved with the preparation of food at home. Obviously it includes the kitchen and everything in it. Indirectly it includes the kitchen appliance trade, the cookbook industry and that part of the home construction craft that builds the kitchen in the first place.

-The Waste Disposal System: Garbage, processing residues, human and animal wastes are natural by-products of the entire food system. The system that recycles these 'wastes' back to the land is a vital part of the whole system.

-The Government System: Many different governments (state, local, federal) are thoroughly involved in the food system. Government regulates, researches, legislates and taxes the food system.

These major systems compose the larger system. While each system is a definable entity, the definitions are also somewhat arbitrary and artificial. It is often hard to decide where one system stops and another begins. Also there are other ways to break down and analyze the food system that are equally correct. But the important point is not how the system is broken down but how it is put together, how it operates and what impedes or threatens its continued operation.

3.0 THE PRODUCTION SYSTEM

Agriculture is the basis of all food systems. A sustainable production system is a prerequisite for a sustainable food system. Neither Montana nor the nation have anything approaching a stable, sustainable production system.

In Montana, agriculture is the number one industry with gross receipts more than double that of the next most important industry, oil and gas. In 1980, the state's farms and ranches contributed $1.5 billion to Montana's economy.(8) It is not surprising that agriculture is so important in the state since 66 percent of the state's land is in ranches and farms - 62,100,000 acres - the second highest in the nation.(9)

Yet while Montana ranks second in number of acres in ranches and farms, it only ranks 32nd in agricultural income. That fact points out what Montana farmers know well: it takes a lot of land to make a living in agriculture in Montana. Eastern Montana, where most ranches and farms are located, is a dry land that Stephen Long, a government explorer, dubbed 'the Great American Desert' in 1820.(10) Later in the nineteenth century, ranchers discovered that this 'desert' could raise excellent beef, and in the early part of the twentieth century farmers found that the ploughed up 'desert' could grow bumper crops of wheat. Stephen Long was not entirely wrong though; eastern Montana is a semi-arid land that experiences extreme climate fluctuations. Ranchers learned this lesson during the winter of 1886-87 when the combination of a summer drought,

overgrazing and an unexpectedly severe winter killed 60 percent of the cattle herds in the state.(11) Farmers also learned this lesson when extended drought during 1917-19 prompted the exodus of 40-60,000 homesteaders.(12) Those who remained had to learn to live with the land, to understand what it is and is not capable of.

In the years since the Great Depression, Montana agriculture has learned to farm the plains. It has not been easy; agriculture has always been a risky business. In recent years it has barely been profitable. Plus there are new risks and threats to Montana's agriculture that could make the years ahead even more difficult.

3.1 Threats To Agriculture

3.1.1 Development -

At first glance, the withdrawal of productive land from agriculture by urban, rural and commercial development does not seem to be a serious problem in Montana as it is in much of the nation. In the U.S. overall three million acres of cropland and potential cropland are lost through development each year.(13) In Montana, land in farms has remained a fairly constant 62,100,000 acres since 1977.(14) Even though the number of acres in production has not decreased, there are important changes occurring in agricultural lands that could adversely affect our food system.

Changes in agricultural lands can be hidden by the substitution of marginal lands for prime agricultural lands, by the way that farms are defined and by the nature of Montana's subdivision law.

The U.S.D.A. "defines a farm, for statistical purposes, as "any place from which $1000 or more of agricultural products were sold or normally would have been sold during the census year."(15) Under this definition, a family with a one-acre lot and a large garden could be considered a farm family. Also a large ranch could be broken up into 'ranchettes' of twenty acres each, and if each owner had a garden and a little livestock, then there would not be any change, statistically, in acres of agricultural land. Realistically though, the output of the former ranch would be altered.

Such a subdivision process has been taking place in Montana. The number of farms in Montana has increased by 100 each year for the past five years.(16) In Missoula, Ravalli, Flathead, Gallatin and other counties, large ranches have been subdivided into semi-residential ranchettes.

Montana's subdivision law partially obscures such development. The law only applies to subdivisions where land is being divided into parcels smaller than 20 acres. Therefore agricultural land can be sold off in lots of 20 acres or more without review, and then the new owners can further divide the land through occasional sales which are exempt from the subdivision law. The net effect is that significant changes

can occur in Montana agricultural lands without showing up in yearly agricultural statistics.

One example of such hidden development can be found in Gallatin County. According to Gordon Watson, state coordinator of the National Resources Inventory, statistics show that 28,660 acres of the county are occupied by residential and commercial uses, but semi-residential development has removed perhaps another 170,000 acres from traditional production.(17)

While the conversion of ranches to ranchettes permanently removes these lands from large-scale agricultural production, not all aspects of this development have a necessarily negative impact on food production. If the ranchette owners use their mini-farms for the intensive production of fruits and vegetables or even of hay and livestock, then the net long-term effect of such conversion will be neutral or even positive. The part-time farmers will probably engage in a more labor-intensive, energy-conserving production process than the large-scale producers. But if the ranchette owners leave the land permanently fallow or abuse the land with erosion-producing practices, then the effect will be negative.

Not all development is in the form of ranchettes. "In Montana 350,000 acres of agricultural land were converted to urban, built-up, transportation and water uses from 1967 to 1977."(18) Farmers on the fringes of expanding cities and towns face unique pressures. 'Leap-frog' development may isolate patches of agricultural land within increasingly urban

surroundings. The inflated land prices that accompany such development pressures farmers to sell out. Also the normal agricultural practices of the farmer or rancher come into conflict with the desires of the more numerous new residents further increasing the pressures on the farmer.

Often times the land developed around cities and towns is the better agricultural land in the state. While the total number of acres in agriculture may be maintained by bringing marginal lands into production, a net loss has still occurred. Not only has the increased productivity of the developed prime agricultural land been lost, the farming of marginal lands leads to increased erosion with increased pollution of air and water in the state.

In summary, development is affecting Montana's agriculture in ways that are not completely recorded. It does not seem to be a problem out of control, but in order to guarantee the sustainability of Montana's production system, development needs to be more closely monitored.

3.1.2 Erosion -

In the United States, erosion is one of the gravest threats to the long-term productiveness of the food system. The 'tolerable rate' of soil erosion, the maximum at which the soil's fertility can be sustained, is about five tons per acre per year. In the U.S. the average soil loss per acre due to wind, sheet and rill erosion is around 5.1 tons per year, and

in Montana the rate is about 4.9 tons per acre per year - apparently not a critical problem.(19) These average figures obscure the serious damage that is occurring; also, erosion losses due to irrigation or snow melt are not calculated. Also, in Montana the tolerable rate of soil loss is not the same on all land; it varies in the range of two to five tons per year. (20)

Actual erosion rates depend on types of soil, locality, local weather, crop grown and farming practices. Some uses, such as hay production, result in little erosion while other uses, such as summer fallow production of wheat, produce much higher soil losses.

Soil that requires centuries to accumulate can blow away in a short time on the edge of a hot, dry wind or wash away in a sudden downpour. Sustainable agriculture cannot be built upon eroding topsoil, and much of Montana's farm-land is eroding at a degrading rate.

In 1977 Montana had 2.7 million acres of cropland with wind erosion rates of 5 - 14 tons/acre/year plus 774 thousand acres losing soil to the wind faster than 14 tons/acre/year. Sheet and rill erosion damaged 500 thousand acres of cropland and 2.4 million acres of pasture or grazing land at a rate of 5 - 14 tons/acre/year. This water erosion also caused 61 thousand acres of cropland and 1.2 million acres of grazing land to shed their topsoil at rates above 14 tons/acre/year.(21)

About 70 percent of the land in farms and ranches in Montana is rangeland and pasture.(22) Approximately 43 percent of the rangeland is judged to be in poor to very poor condition which means that more than 60 percent of the "present vegetation and ground cover depart from that which is presumed to be the natural potential of the site."(23) The Resource Conservation Plan of the Montana Conservation Districts asserts that "Montana's rangeland has historically been abused through overgrazing and mismanagement" and that the state's rangelands are producing at only 59 percent of their potential.(24) Range improvement would not only increase production, it would also decrease erosion and pollution of the water and the air.

Wind is the most serious erosive force in Montana. The state has the second worst wind erosion problem in the nation.(25) It is a preventable problem that is aggravated by cropping and cultivating practices and by cyclical dry spells. Summer fallowing, which leaves the wheat fields unprotected by plant cover, greatly contributes to the wind erosion problems. The areas of the state that suffer most from wind erosion, such as the north-central triangle area and the Highline, are also prime wheat growing areas where summer fallowing is a common practice. Only North Dakota has more acres in summer fallow than Montana, and accordingly North Dakota has the worst wind erosion problems in the nation.(26)

Wind erosion does not just strip the land of its soil; it removes the most fertile part of the soil: the finer particles that contain most of the soil's nutrients. The fine air-borne particles may have up to 9 times the nitrogen, 19 times the phosphorous and 10 times the organic matter as the soil left behind. A Canadian soil scientist discovered after a 1981 dust storm in Canada that samples of the fine dirt swept into the ditches by the wind were five times richer in nitrogen than the samples from the eroded fields.(27)

So the costs of soil erosion are many. The loss of topsoil will eventually be reflected in decreased yields. Counteracting the yield decrease will require increased applications of expensive fertilizers. A cost that the individual farmer does not have to pay but is borne by the whole society is the degradation of air and water quality that results from erosion. One of the most obvious short term costs is nutrient and water loss.

What would it cost to actually replace the soil lost to erosion? That is very hard, if not impossible, to calculate. Nature requires anywhere from 100 to 1500 years to generate an inch of topsoil. If all the soil in excess of the tolerable rate lost each year in Montana was replaced with 'manufactured' soil - compost - the bill would be $2 - 4 billion a year.(28)

3.1.3 Saline Seep -

In addition to wind erosion, summer fallowing can result in saline seep. The purpose of summer fallowing is to control weeds and to accumulate soil moisture for the next summer's wheat crop. Particularly during a wet year, excess moisture can accumulate in the soil. When this excess water sinks down through the soil and subsoil, it dissolves the naturally occurring salts. Often the salt laden water flows downhill and emerges in the form of a low volume spring. Then as the water evaporates, a salty crust is left behind causing the production of crops or grass on that land to be decreased or eliminated.

In 1978 an estimated 200,000 acres were out of production due to saline seep. And that figure may be too conservative.(29) Furthermore, saline seep land is expanding on the average by ten percent a year. "Expansion of seep areas by 20 to 200 percent in wet years is not uncommon, whereas expansion of only a few percent may occur in dry years."(30) New figures on the exact extent of saline seep are not yet available, but a conservative estimate would be that more than 250,000 acres are now lost to production.(31) It is possible to restore saline seeps to production over a period of 10 - 15 years if correct conservation practices are carefully followed.(32)

Besides damaging agricultural land, saline seep may also be contributing to the salinity of surface and ground water through the salt contamination of reservoirs, streams and also

of shallow acquifers.

3.1.4 Coal And Agriculture -

Whether or not coal development harms agriculture is a question that is still open to debate. Yet it is true that coal development does not in any way aid agriculture; therefore, any impact on agriculture from coal will be negative. Supporters of coal development contend that over the long-run these impacts will be negligible. Critics insist that the opposite is true. Who is right? Only time will tell. If time does show that coal development hurts agriculture in Montana, then it will have been an expensive experiment for an agricultural state.

Coal development affects agriculture in many ways: Land is directly removed from production for the mines and their support facilities, for coal-fired generating plants and their support facilities and for high-voltage transmission lines. High-voltage power lines create an obstacle and a hazard to farmers whose fields they cross. Coal development competes with farmers for water in some areas, and coal mining disrupts acquifers in the area of the coal mine while posing a potential threat of ground water pollution. Finally the emissions of coal-fired power plants produce acid rain and other pollutants that can decrease crop yields, and the plants increase atmospheric carbon dioxide.

Acid rain has been shown to inhibit the growth of a variety of grasses. During times of additional stress, such as would result from drought and severe winter, small grains and grasses in eastern Montana that are subjected to this pollution may be less able to withstand stress. Thus pollution may not destroy the land directly, but it can weaken its ability to survive the climatic variation that is a fact of life on the Montana plains.(33)

High-voltage power lines produce a powerful electro-magnetic field whose effects on living matter are not yet fully researched. Some studies indicate that this field disrupts living processes.(34) What is known is that farmers working in the vicinity of high-power lines can be severely shocked or electrocuted. Irrigation systems operated around transmission lines are particularly hazardous. "Even without these kinds of problems, farmers face disruptions and added costs in their operations where power line structures are placed in their fields."(35)

It seems reasonable to question the compatibility of a sustainable agriculture and coal development. Coal development will not go away, but it should be recognized as a stop-gap measure. Without an agressive movement toward a sustainable society, coal development only postpones the necessary transition to renewable fuels: a transition that will only be more difficult with the passing years. As Montana historian K. Ross Toole said, "Whatever the final revenue Montana may gain from the mining of coal, the process is ephemeral. Agriculture

is self-renewing."(36)

3.2 ECONOMICS AND THE STRUCTURE OF AGRICULTURE IN MONTANA

Even if agricultural land was not being threatened by land development, erosion, saline seep and energy production, the abiding problem of agriculture would still remain: it is a risky way to make a living.

The average farmer works long hours that would send his/her urban counterpart to the picket line. Farming is hazardous, the third most dangerous occupation in the country. Nation-wide there are 200,000 disablng injuries and 2,000 deaths per year from farm accidents. Also, the farmer has a higher risk of dying from leukemia, skin tumors and physical agents (herbicides, pesticides and other chemicals) than the rest of the population.(37)

In addition to the health risks, the farmer faces harsh economic risks. The income of the individual farmer is dependent on an array of conditions outside of his control. Farm income is extremely volatile, surging or declining from one year to the next. Since 1975 cash receipts from marketings have only exceeded production expenses twice for the state's agriculture. Were it not for government payments, Montana agriculture overall would not have been able to pay its bills in the other years.(38)

Low farm income has been a recognized national problem for decades and an assumed responsibility of the Federal government since the 1930's. Yet with all the government programs designed to boost farm income and 'save' the family farm, poverty is prevalent, income is erratic and family farms continue to disappear. Why? What is the farm problem?

The farm problem is not really one problem but a whole series of interconnected problems. In part, the farm problem is a chronic overproduction of agricultural products. At the same time, the last decade has shown that problems of surplus can be rapidly replaced by problems of shortage. Through it all, the individual farmer is caught in the middle trying to effectively respond to inflation, to the erratic acts of governments and to the pressures of large agribusiness firms.

Francis Moore Lappe, identifying one aspect of the farm problem, testified before the Committee on Agriculture of the U.S. House of Representatives that the farm problem "is the dynamic underlying the farm economy in which farmers are squeezed between rising costs and falling prices for their production. The root cause of the farm squeeze is that farmers are largely price takers, but they must confront price makers both when they buy what they need to make land produce and when they sell their crops."(39)

To understand why this is so requires an understanding of basic agricultural economics.

The demand for agricultural products in the U.S. is relatively price and income inelastic; that is, when product price or consumer income fluctuate, the quantity demanded of basic agricultural commodities remains relatively stable. If prices double, people do not eat half as much, and if incomes double, people do not double their caloric intake (assuming that they were already receiving adequate nutrition). A person with increasing income may spend more money on food by dining out or purchasing more expensive, more processed foods, but her consumption of pounds of wheat, vegetables or meat changes only within certain narrow limits in the short run. Also, if the supply of a basic commodity such as wheat increases, price will have to decrease dramatically to induce increased consumption - particularly when foods are processed. Agriculture's share of the retail price of processed food decreases as processing increases. For example, farmers only receive five and a half cents out of every 52 cents spent on white bread; the remainder goes to milling, baking and retailing.(40) A decrease in the price of wheat by 50 percent would have little effect - scarcely 3 cents - upon the price, and therefore the consumption of bread.

Individual farmers can do nothing to effect the prices they receive; they are price takers. In their view the way to increase income is to increase output. Since all farmers will have the same view, they will all increase production, and the increased production will depress the prices that they receive. The final result may be that there is no net gain at all to the

farmers from their increased production.

This discussion may seem far removed from the problems of agriculture and of the food system, but these basic economics have a direct bearing on how much food is grown, how it is grown and whether it will continue to be grown and sold in stable quantities, qualities and prices. Still these economic principles are not the only ones that determine the income of agriculture.

The forces affecting the market that confronts the Montana farmer are national and international, are ruled by the interests of nations and of the large agribusiness firms that sell supplies to the farmers and buy, process and distribute their product. It is with these large corporations that the farmer must compete for his or her share of the retail food dollar.

Both the input and output markets of agriculture have a number of giant firms that are price leaders, 'price makers' that possess power and influence with which the individual farmer can not begin to compete. Some of the results of this situation are:

*Between 1959 and 1977 the prices paid by farmers for supplies increased every year except one while farm prices dropped five times.(41)

*In 1972 four U.S. tractor manufacturers, producers of 75 percent of tractors sold in America at the time, overcharged U.S. farmers $251 million according to U.S. Trade Commission statistics.(42)

*In the same year the animal feed industry, dominated by Purina and Cargill, overcharged farmers by about $200 million.(43)

*Five large grain companies control 85 percent of U.S. grain exports.

*The largest grain company, Cargill Corporation, had a 441 percent profit increase (in constant dollars) since the late 1960's while the real income of farmers has not improved.(44)

*During the past ten years, 60 small seed companies were bought up by 20 large corporations so that the seed trade is becoming dominated by a few large firms. This trend plus the introduction of restrictive varietal legislation leads, some critics say, to decreased genetic diversity and increased vulnerability.(45)

Cargill, a private corporation controlled by just two families, epitomizes the development of multinational agribusiness conglomerates that now dominate the food system. Cargill is the largest private corporation in the U.S. with sales in 1979 of $12.6 billion(46), and it is involved in all facets of the food system. It sells seed, feed, fertilizer and farm equipment. It has a Poultry Products Division, a poultry

breeding operation, beef feedlots and owns the second largest meat packing firm in the world, MPBXL Corporation. In the grain trade Cargill, the world's largest grain trader, has an integrated system of country, terminal and port elevators; a sophisticated transportation network that includes 1500 rail cars and a number of barge companies; plus several grain processing plants. Cargill's Seaboard Allied Milling Corporation is the largest flour miller in the world. To finance its world-wide operations Cargill can draw on the resources of the three insurance companies and one bank that it owns. When that is insufficient to cover its credit demands, Cargill can access an unsecured line of credit from the nation's major commercial banks. Finally in order to wheel and deal in the international marketplace - and to protect a portion of its profits on the sale of U.S. grain from U.S. taxation - Cargill operates international corporations headquartered in Panama and Switzerland.(47)

Clearly agribusiness firms such as Cargill have the resources and the abilities to manipulate markets for their own profits to the detriment of smaller producers. Even if such manipulation had not been documented in books such as MERCHANTS OF GRAIN by Dan Morgan or A POOR HARVEST by Richard Gilmore, it would be naive to assume that such market machinations do not exist. Particularly in the grain trade, such firms are ideally situated through their global information networks to perceive hidden trends in the movement of agricultural supply and demand, and to rapidly benefit from their inside information.

The benefit comes though at the expense of the individual farmers who do not have an intelligence network of similar scope to inform them of impending foreign grain sales or of crop conditions and demand around the world.(48)

What does all this have to do with Montana's food production system? About 80 percent of agricultural income in the state is derived from two products: cattle/calves and wheat. In 1980, 60 percent of the Montana wheat crop was exported out of the country.(49) There is an aggressive program in the state to promote the foreign consumption of Montana wheat and other agricultural products. Yet this policy by itself will not insulate the Montana wheat farmer from the vagaries of the market or the activities of agribusiness.

An aggressive wheat export program may in the short run benefit the wheat farmer, but the long run result of such a policy is indeterminate. The expansion of foreign markets does not result in just marketing current production at a higher price, it also encourages expanded production. The higher price draws marginal lands into production. The net result may be that total production increases, the need to sustain and continue to expand exports increases - and soil erosion increases. There is a definite trade off between controlling erosion and an aggressive production/export strategy. Also such an export-focused policy increases the vulnerability of Montana's agriculture to price fluctuations resulting from changes in foreign demand, from operations of large grain traders and from policy changes of foreign governments.

Increasing dependence on agricultural export may increase income in some years, but it will also increase the fluctuations in income. A TIME TO CHOOSE, a study by the USDA, predicted that "... vacillation between short periods of comfortable supplies and discomfitting shortages will occur with increased frequency... Recent projections suggest that the price volatility which could result from such vacillation between shortages and surpluses may be even greater than in the 1970's."(50)

There are many important questions about the economics and structure of agriculture in Montana that this report has neither posed nor attempted to answer. For example, what changes are occurring in farm tenure in the state? How does farm tenure, whether the farm is owned or rented by its operator, affect the operation of farms? There is some evidence that suggests that farms operated by non-owners have increased erosion problems.(51) If non-owner operation is increasing, will erosion also increase?

Questions like these need to continue to be studied in the context of food system analysis in order to understand the future of Montana's food system.

4.0 THE WATER SYSTEM

While most people do not think of water as food, it is a vital nutrient. On the average we each need to drink at least two and a third quarts a day. Beyond this bare necessity

though our food sytem requires large quantities of water.

The manner in which the food system utilizes water is crucial to the continued supply of clean water and to the overall health of the state and the nation's rivers and lakes. Careless irrigation and insufficient treatment of municipal wastewater can quickly degrade the quality of rivers. Carried to an extreme, such careless practices can render the remaining water in a river unfit for any use.

Irrigation uses 95 percent of water consumed in the state. Municipal, industrial and other rural uses consume the rest. In 1981, 18 percent of acres harvested in the state were irrigated.(52) Between 1974-78 an average of 19 percent of harvested acres were irrigated, and these irrigated acres yielded 28 percent of the value of crop production.(53) Sixty percent of all hay harvested came from irrigated land.(54) While most of the land that can be irrigated by simple gravity diversion has already been developed, one study calculated that Montana has 11.5 million more acres suitable for irrigation with 3 million of those acres of high potential.(55)

The main source of irrigation water is diverted flow from rivers, creeks or impoundments; only one percent is pumped from wells.(56) Many dams impounding water for irrigation are in need of repair. For example, the state directly owns 25 dams that provide irrigation to 100,000 acres. Twenty-one of these are listed as high-hazard dams, and the cost of making needed repairs would be $150 - 200 million.(57)

Only about one-fourth of water diverted for irrigation is actually used by the crop. The rest is either lost through leakage, evaporation or returned to the stream. Irrigation run-off returned to the stream produces pollution problems in three ways. First, evaporation has concentrated salts already present in the water, so that the returned water will have increased salinity. Second, return flow contains additional salts dissolved from the irrigated fields. Each acre of irrigated land can add one-half to two tons of salts to streams each year.(58) Finally, streams can be so dewatered by irrigation and other uses that the remaining water is unfit for any use. Such is already the case in some lower parts of the Yellowstone drainage where salinity levels are too high for municipal supply and drinking water.(59)

5.0 THE ENERGY SYSTEM

"If the nation were trying to plan a strategy that would make American farmers most dangerously vulnerable to price inflation based on a petroleum shortage, it would be hard to plan one more effective than the recent trends in the use of chemicals and power machinery.."(60) - Ralph Sampson

"To feed the entire world with a U.S. type food system, almost 80 percent of the world's annual energy expediture would be required just for the food system."(61)

The essence of food production is the transformation of solar energy into plant matter. Upon this conversion our lives depend. In subsistence agriculture, human and animal energy, directly fueled by plants, powers the food system. In our more sophisticated system, fossil fuels replace human and animal power. Yet we all know that these energy sources are finite

and non-renewable. A stable, sustainable food system should begin substituting renewable energy sources for fossil fuels.

Unfortunately, Montana's (and the nation's) food system has been doing exactly the opposite for the last forty years. Every system that makes up the food system is dependent upon the input of large quantities of fossil fuels. The fact that most consumers spend a smaller part of their income for food then they would have forty years ago is due in large part to the food system switching from labor intensive producton to energy intensive production. Our food system has been constructed upon a foundation of nonrenewable fossil fuels.

The United States food system requires about 17 percent of all commercial energy used annually. Farm production consumes about 15 percent of the food system non-solar energy budget; food processing uses about 30 percent, marketing and distribution about 11 percent, commercial eating establishments 17 percent and home food preparation and use 27 percent. (62)

Agriculture has benefited most perhaps from the substitution of fossil fuel energies for human labor power energies. the increases in labor productivity in the last four decades are due mostly to the mechanization of farming. This mechanization has not come at a high price in fuel use, relative to overall energy consumption. Agriculture only consumes about 3 percent of the nation's energy.(63) In Montana, agriculture consumes about 4.5 percent of energy in the state.(64) But this small percentage is very important;

agriculture cannot easily do without it. So dependent is agriculture on this energy input that one study reports that a doubling of energy prices would result in only a 5 percent reduction in total energy used in agriculture in the short run, and a 20 percent reduction in the nation's energy supply would produce a 55 percent rise in raw commodity prices.(65) This inelastic demand is attributed to the seasonal nature of farm operations, to the difficulty of quickly substituting human labor for machines and to the massive use of pesticides and herbicides.

The largest share of agricultural energy in Montana, about 44 percent, was consumed by pesticides and fertilizers. Field operations and farm vehicles use almost the same percentage of the energy budget, 23.3 and 22.8 percent respectively. The remainder, 9.5 percent, is utilized by all other farm operations: irrigation, crop drying, milking and milk cooling, etc.(66)

Not only is agriculture's demand for energy very inflexible, it is also very vulnerable to disruptions in foreign supply of crude oil. Overall 74 percent of the energy used in the U.S. is derived from petroleum-based energy. In contrast, 93 percent of energy devoted to agriculture originates from petroleum.(67)

It should be no surprise to anyone that energy costs in Montana's agriculture nearly tripled from 1975 to 1980. But then all agricultural production expenses were rising during

the same period; the share of production expenses spent on petroleum products and fertilizer increased from 10.5 percent in 1975 to 13 percent in 1980.(68)

Beef prices may be most susceptible to variation due to energy costs since beef production accounts for approximately 25 percent of agriculture's energy usage.(69) The majority of this energy, perhaps 75 percent, is devoted to feed production.(70) Since most of the cattle in Montana are shipped to other states for finishing, beef production in the state is not as energy intensive as elsewhere. In general, feedlot beef requires 10 or more calories of non-solar energy subsidy for every calorie of food output whereas range-fed beef requires less than one calorie of non-solar energy input per calorie of output.(71)

The ratio between calories of energy input to agriculture and the number of calories output has steadily increased over the last forty years. "While we have about doubled farm output in the last 30 years, we have more than quadrupled our fuel consumption - so that farm output per gallon of fuel has declined by half."(72) In and of itself this energy subsidy is not necessarily a bad thing. The conversion of inedible petroleum calories into edible food calories through agricultural production is a highly valuable conversion and may be one of the best uses of fossil fuels. The problem is not that more calories of energy are put into production than are gotten out. The problems, as pointed out previously, are that these energy sources are non- renewable, will eventually be

exhausted and the dependence on these energy sources makes agriculture very vulnerable to energy disruptions.

In recent years there has been a lot of hope invested in gasohol production. Some see gasohol production from grain as one way to free agriculture from its OPEC energy dependence. The impracticality of this proposal has been pointed out a number of times. To replace the gasoline and diesel used in American agriculture with gasohol would require the production from 133 million acres of corn.(73) According to agriculture expert Don Paarlberg, many studies indicate that more energy is used in producing alcohol than it yields.(74) A 1978 study, FEASIBILITY OF ETHANOL FROM GRAIN IN MONTANA, concluded that even with the most optimistic view, a Montana grain fermentation plant would not be a good investment without massive subsidies.(75) And finally, a massive investment in gasohol production would lock agriculture into intensive cropping practices that would further increase erosion, increase energy intensive production and escalate food prices.

A better strategy would be for agriculture to begin adopting and experimenting with renewable energy forms - not because energy use by agriculture is somehow 'bad', but because the energy usage patterns of agriculture threaten its stability.

During the research for this report, no study of the energy usage patterns of Montana's food system was found. This short description has by no means been complete. A thorough

understanding of the state's food system requires such a study.

6.0 THE TRANSPORTATION SYSTEM

Transportation is particularly important to Montana's food system for three main reasons:

First, Montana's agriculture is export oriented. A reliable transportation system means that Montana produce can reach distant markets. Transportation costs amount to as much as one-third of some grain growers' costs.(76)

Second, the majority of food consumed in the state is shipped in from other states.

Third, Montana's large surface area and low population means that the state's extensive transportation network must be supported by fewer people than in other states. Montana has the highest ratio of highway miles to population of any state in the union.(77) This places a financial burden on Montana's population, and creates a financial challenge for its transportation system.

Without an adequate transportation system, Montana's entire food system will suffer. At the present time, the state's transportation system faces increased strain and deterioration.

6.1 The Highway System

The Governor's Transportation Advisory Council recently reported that "In Montana, transportation problems are approaching crisis proportions." They also warned that "...the state's major capital asset, its highways, faces ruin."(78)

Montana has 5400 miles of primary highways of which 474 require immediate reconstruction. Within the next five to ten years, this figure will increase to over 2,194 miles.(79) In other words, almost 50 percent of Montana's major highways will have to be rebuilt during this decade. Just to reconstruct the 474 miles that need rebuilding now will cost $286 million. Renewing the total 2,194 miles of highway will cost a staggering $1.3 billion.(80) As large as these figures are, they do not include necessary repairs of secondary roads.

Patterns of highway usage are connected to the railroad system. Any shipper in the state has to choose between the two systems. Sixty percent of Montana communities have no choice; they have no rail service.(81)

6.2 The Railroad System

Prior to its abandonment, the Milwaukee Railroad hauled approximately 15 percent of Montana grain shipped by rail. The Milwaukee shutdown affected 25 - 30 million bushels of grain. Since its closure some farmers have had to change crops due to increased shipping costs, and others have had to truck their grain longer distances often over secondary roads not built to

withstand the heavier traffic.(82)

Burlington Northern has a virtual monopoly on rail transportation of grain in the state now. They haul 90 percent of the state's grain. Two actions on their part also contribute to increased hauling of grain by truck. First, they are abandoning about 10 percent of their track which carries about 3 percent of their volume. Second, they have instituted 52-car unit trains. Not all elevators will install facilities for loading unit trains, and among those that do, it is expected that some will go out of business. Fewer loading points will mean longer hauling distances for some farmers. For other farmers the lower shipping costs of the unit trains are a benefit.

The changes in the railroad system mean more pressure on highways. Increased truck traffic results in increased damage to the roads, particularly if trucks are overloaded. An axle carrying 24,000 pounds does three times the damage of an 18,000 pound axle. It is difficult to enforce weight restrictions in Montana, and the incentives to overload are great. A random survey of truck loads at various Great Falls elevators revealed a pattern of overloading with 69 percent of overloaded trucks carrying an average of 20,700 pounds per axle.(83)

Governor Ted Schwinden has said, "The fact is, you can't talk about agriculture in Montana without talking about transportation."(84) The same can be said about the entire food system. Its stability is directly related to the reliability

and costs of transportation.

7.0 THE PROCESSING SYSTEM

Most agricultural products, about 75 percent (85), are processed in some manner before being purchased by the consumer. In Montana, most of the food consumed is not processed in the state. The manufacturing of food and kindred products employed about 3300 workers in Montana in 1980 (86). The majority of these workers were concentrated in meat packing, dairy product production, grain mill products, bakery products and beverage production. The 1980-81 Directory of Montana Manufacturers lists 95 firms manufacturing food and kindred products in the state. Included in this counting, though, are four ice manufacturers, 13 soft drink bottlers and 21 animal feed firms. While there are many small food processors in the state, it is difficult to obtain information about them and about the scope of the processing industry in general in the state. Even so, it is safe to conclude that, except for the above mentioned products, almost all canned goods, frozen foods, breakfast cereals, most beverages and other processed foods are produced outside the state and shipped in. Therefore, to understand the food processing part of Montana's food system it is necessary to examine the larger food processing system.

The food processing industry is characterized by both slow, steady growth and by rapid fluctuations. The volume of food sold increases about one percent a year in step with population increases. At the same time, some sections of the industry experience rapid growth while others decline. Therefore, while total sales nationwide increase slowly, an individual firm that can capture the public's fancy with a new product will have faster sales increases. An emphasis on packaging and promotion results.

The food processing system is the largest energy consumer in the overall food system. It is sixth in energy consumption of all U.S. industries consuming seven percent of industrial energy.(87) Only about one-third of this energy is a direct input. The majority ends up in packaging, buildings and machinery or in transportation.(88)

The food processing and marketing industry has both competitive and non-competitive elements. As mentioned, growth within segments of the industry can be very rapid. But other segments are characterized by the dominance of a few firms. For example, two firms, Kellogs and General Mills, control 62 percent of breakfast cereal sales.(89) Even the apparent diversity of products hides the real extent of corporate dominance. For example, Beatrice Foods markets 5000 products under 100 labels.(90)

Such concentration and market power can produce large sales and profits. At least 45 food companies had 1981 sales in excess of $1 billion. Market power can translate into higher consumer prices. "The Federal Trade Commission estimated that the concentrated food industry extracted $2.6 billion in overcharges on seventeen food lines alone" in 1972.(91) The food industry continues to be concentrated in fewer and fewer firms. The General Accounting Office claims, "Merger activity is causing 3 percent of all food manufacturing firms to disappear each year. Since 1975, merger activity has increased thirtyfold among food chains."(92)

Research did not produce any study detailing the relationship between the food processing industry and Montana's food system. Further study is necessary in order to determine how changes in the structure of the food industry can affect the state's food supply and to determine to what extent in-state processing can be promoted.

8.0 THE DISTRIBUTION SYSTEM

The distribution system delivers food into the hands of the consumer. It includes supermarkets, convenience stores, corner grocers, specialized food stores, farmers' markets, roadside stands, local restaurants, franchised restaurants, school cafeterias, even vending machines.

In many ways the distribution system and the processing system blend together. Supermarkets and restaurants process many of the foods they sell. In house bakeries are common in supermarkets. Some structures of the food system which form a bridge between the processing and distribution system are difficult to place solely within either system. For example, food wholesalers and warehousers may be owned and operated by firms that are primarily processors or by firms that are primarily distributors.

The distribution system is the direct link between the consumer and the food system. In 1980, Montanans spent about $1 billion on food.(93) The distribution system employed over 28,000 people in 1980 who received $175 million in wages.(94) This system not only is the direct link between consumers and the food system, but it also plays an important role in food storage. The ability of a food system to withstand supply disruptions caused by bad weather, strikes or other pressures depends to a great degree upon the supplies and reserves of the distribution system.

Apparently, there have been no thorough studies of supermarket and retail food trade in Montana. Therefore, detailed information about the grocery industry in Montana is not readily available. Yet, a general understanding of the industry in the state can be obtained from examining the national trends in the grocery industry since major national supermarket chains are an important part of the grocery industry in Montana.

Nationwide, supermarkets receive 70 cents out of every dollar spent on groceries.(95) Probably this ratio holds true for Montana since the average number of supermarkets in Montana per 100,000 people - 13.5 - is close to the national average of 12.6 stores per 100,000 people.(96) The trend in recent years has been toward fewer but larger supermarkets. Accompanying this trend has been the increase in convenience stores. Excluding gas sales, convenience stores now account for almost 6 percent of grocery sales.(97) The growth of convenience stores is reflected in the fact that Southland Corporation, operator of Seven-Eleven, had 1981 sales that were larger than those of the seventh largest supermarket chain.(98)

The average consumer spends as much as 37 percent of her food budget on food eaten away from home. The amount of money spent on eating out has been a rather constant 4.75 percent of disposable personal income for the last two decades.(99) What has changed during this time period is where that money has been spent. In the last 25 years, nationally owned or franchised restaurants have been steadily replacing locally owned restaurants.(100) This is a trend that does not appear to have peaked either. The number of food franchises increased by 50 percent between 1975 and 1981.(101) The president of McDonald's forsaw no end to the expansion in a 1979 interview: "I really believe that the years in which we can continue to pump in 350-400 stores domestically go on ad infinitum.."(102)

While consumers around the state and the nation have responded to the development and promotion of national restaurant chains in general and fast food chains in particular with an apparently insatiable appetite, this development is not without its problems, particularly in a state such as Montana. First, fast food is a highly packaged food. This packaging increases cost, is highly energy intensive and while it may boost individual sales, it does not improve nutrition. Second, the displacement of locally owned restaurants by franchises weakens the local economy. Particularly in a small business-oriented state like Montana, the growth of the franchise trade leaves less wealth within the community. The franchised restaurants are more likely to buy supplies from out of state suppliers and their profits are likely to flow out of the state. Third, franchised restaurants are less likely to respond to local variations in demand. Fourth, many fast food restaurants use imported beef in their hamburgers. About one-fourth of all beef consumed in the United States is consumed in fast food restaurants. Much of this is imported from South and Central America where the tropical forests are being destroyed to feed the fast food trade.(103) The impact on U.S. beef production is not negligible.

9.0 THE HOME FOOD SYSTEM

The home food system is a crucial part of the entire food system, and it is a major determinant of social patterns of food selection, preparation and storage, of nourishment, of

energy usage and of waste disposal. The home food system contains within it elements of many other components of the food system. It produces, processes, transports and distributes food. Finally the home food system represents a substantial investment that might be initially overlooked.

How large is the home food system?

*If kitchen construction accounts for 10 percent of the cost of constructing a new home, then new kitchens cost $20 million in 1980 in Montana - $873 million in the U.S.(104)

*Nationally, the per capita value of major kitchen appliances shipped in 1980 was about $35. If Montanans purchased their share of these appliances, then they spent $27 million on them.(105)

*Similarly, the expenditures in Montana in 1980 on small electric kitchen appliances was perhaps $6 million.(106)

*The home food system is responsible for about one-fourth of residential energy consumption.(107) Thus the home food system in Montana consumed over $37 million of energy in 1979.(108)

*On the production side, Montana's 82,360 gardens produced 48 million pounds of food saving gardeners $36 million in 1980. Montana's gardeners spent around $4 million on garden supplies and equipment to cultivate 1,253 acres.(109)

*Food purchased for home preparation in 1980 in the state cost $740 million.(110)

*A conservative estimate of state expenditures on the home food system (excluding purchases of non-electric equipment, expenditures on transportation for shopping and on kitchen remodeling) would be at least $834 million.(111)

10.0 THE 'WASTE' SYSTEM

The organic product of agricultural lands must be returned to the soil in order to sustain fertility. While a large part of organic residues are returned to the land, there is still much room for improvement.

The annual production of organic residues is estimated by the USDA to be 800 million dry tons nationwide. The majority of this is a by-product of the food system. The largest component is crop residue - 54 percent of the total. Farm animal manure contributes 22 percent of the total. About one percent, 7.5 million pounds (dry weight), is sewage sludge and food processing waste.(112)

Although a large part of manure and crop residues are returned to the soil, a USDA study notes that improper management of these residues results in nutrient loss. "Under current...practices nearly 63 percent of the nitrogen in manure is lost through improper storage...[and] the maximum benefits of the crop residues returned to the soil...are generally not acheived because current management does not use crop residues

effectively."(113) Improved handling of these agricultural residues will not only improve the fertility of the soil, it will also decrease erosion and water pollution while conserving soil moisture. A 1974 USDA study estimated that 914 million pounds of manure and 100 million pounds of nitrogen were lost from manure storage and waste handling systems in Montana.(114)

While sewage does not compose a large percentage of total organic residues, it is a rich source of organic matter. One of the prime uses of municipal water is for the transportation of human metabolic residues. Treating wastewater, extracting the sludge and protecting the quality of the nation's water is an expensive and important part of the food system cycle. About one-fourth of sewage sludge is spread on the land. The rest is burned or dumped.(115) Alternative processes presently exist that can treat sludge for a lower cost while producing a high quality fertilizer. For example, Eko-kompost, a Missoula company operated by resource economist Dr. Joseph Horvath, combines the sludge solution from the Missoula water treatment plant with other organic residues, composts the mixture and then markets the finished product in twelve states. While one-fourth of sewage sludge may be presently spread on the land, processing into compost produces a safer, more reliable product. If composting was an integral part of municipal sewage treatment plants, Dr. Horvath estimates that 40 percent could be saved in the construction and operation costs of Montana sewage plants each year.(116)

Another important organic residue is garbage. A 1974 study estimated that "12 percent of the nation's trucks are engaged in the activity of waste disposal of which a substantial part is related to food."(117) The USDA estimates that "In 1977, about 145 million tons of municipal organic refuse were produced." Very little of this is recycled, about one percent.(118) While there might be problems composting these residues, it has been suggested to burn them for energy generation.

It is a strange process whereby edible food becomes garbage in the first place. Food left behind on the plate of a satisfied diner is usually deemed garbage and discarded. Not only is all the energy and labor that went into producing, processing and distributing the food wasted, additional energy and labor have to be expended in disposing of the residue. One strategy for utilizing this resource is to process the table wastes from large cafeterias into animal feed. It is estimated that such reprocessing would "recapture over 9 billion pounds of food wastes annually (from 150,000 of 500,000 food installations in the U.S.).(119)

Further study of the many varieties of organic refuse specific to Montana could identify ways to implement more complete recycling of food system residues while lowering treatment costs.

11.0 THE GOVERNMENT SYSTEM

Our food system could not exist in its present form without the involvement of government. The operation of every part of the food system is entwined in some way with some level of government. It is not possible to analyze and understand the food system without acknowledging the extent of this involvement which is one of the major roles of governments. The major instruments for effecting this involvement are regulation, inspection, licensing, taxation, direct and indirect control and direct and indirect expenditure. The intensive involvement of government in the food system is at least a tacit acknowledgement that without such supervision the free market food system would not provide the reliability and stability that a society must demand of its food system.

The goal of this part of the report is to broadly outline some of the government's more important roles in the food system.

First, Dave Lewis, Director of Office of Budget and Program Planning for Montana, stated that a "rough guess of the dollars spent by the state on support of the Food Production and Distribution System" would be $237.2 million in 1981 out of a budget of $1.4 billion.(120) The major recipients of these funds were the Departments of Highways, Agriculture, Livestock and Health plus Montana State University and the school lunch program.

A surprising number of meals consumed in Montana each day result from some form of government involvement:

The food stamp program disbursed $18.3 million in 1980 to 46,000 Montana recipients.(121) Nationwide, about three percent of grocery sales are food stamp purchases.(122)

During the 1980-81 school year, the Montana school lunch program served over 15 million meals to 110,000 students. The cost to the students for these hot meals was about 50 - 60 cents while the average cost of preparing the lunches was $1.09 per meal. A comparable meal purchased in a restaurant would have cost $1.25 - $3.50. The difference between the actual cost of each meal and its price was covered by Federal, State and local funds. The majority of the lunch subsidy came from the Federal government which contributed $6.7 million to the Montana school lunch program.(123)

The WIC program (Special Supplemental Food Program for Women, Infants and Children), enacted by Congress in 1972, has been one of the most successful government food programs. It provides nutritional and medical assistance to pregnant, nursing or postpartum women and to their infants and children. The WIC program has definitely reduced the number of underweight babies born to low-income mothers who would have, previous to the program, suffered medical and nutritional problems that would have affected the unborn child: low birth weight is the chief cause of infant death. In addition, low birth weight has been linked with blindness, deafness and

mental and physical retardation.(124) Newsweek columnist George F. Will recently cited a study that "found that every dollar spent on WIC prenatal services saves $3" in future health costs.(125)

The Montana WIC program spent $3.7 million between July 1, 1980 and June 30, 1981 providing food to 22,000 different people. Also during the same period, a parallel program, Child Care Food Program, spent $1.7 million helping feed 2.7 million meals to over 8,000 children in 25 Montana counties.(126)

One measure of the extent of the involvement of the Federal government in the food system can be obtained by examining a list of the principal Federal agencies with major food interests:

1. Commodity Futures Trading Commission
2. Department of Agriculture
3. Department of Commerce
4. Department of Health and Human Services
5. Department of Interior
6. Department of State
7. Department of Labor
8. Department of Transportation
9. Treasury Department
10. Environmental Protection Agency
11. Export-Import Bank of U.S.
12. Farm Credit Administration
13. Federal Reserve (127)

Another measure of government involvement is that government payments to farmers have often meant the difference between profit and loss. Between 1975 and 1980 Montana farmers received $311 million in government payments. In four of those seven years the cash receipts of Montana agriculture would have been insufficient to cover production expenses without the government payments.(128) A 1974 study reported that "...direct government subsidies have accounted for 30 to 40 percent of the farm income and 15 to 30 percent of the National Income attributable to agriculture since 1955."(129)

Unfortunately, all the myriad government programs which are food related are not part of an overall food system strategy. Many programs result from a response to the desires of special interest groups or from a reaction to an emergency instead of being part of an integrated, coherent food system policy. A recent study by the General Accounting Office stated, "World turbulence...has led to new questions about U.S. agriculture's ability to maintain adequate food supplies in domestic and world markets in the future. In the past, little more has been done than reacting to crises. For the 1980's, however, policymakers must face the challenge of anticipating future circumstances and problems confronting the food and agriculture system and begin to plan for actions appropriate to the times."(130)

Long-range planning for the food system must become a role of governments. No other social structure has the scope, authority or power to construct and carry out a coherent, integrated plan for the food system. And the food system is too important a part of everyone's lives to just be left to chance.

12.0 SURPLUS, SHORTAGE OR UNCERTAINTY?

What will be the future of Montana's - and the nation's - food system? Will food continue to be abundantly available at a reasonable cost? Or will there be severe shortages and drastically higher prices?

The answer is uncertain.

Certainly the present food system has produced an abundant supply of food in the past and in the present. If that trend was extrapolated into the future, the answer to the previous questions would be "Yes, there will be abundant food at reasonable price." Other trends though - extrapolated into the future - such as problems of soil erosion, farm land development, ground water depletion, increased energy and transportation costs, etc. point to future shortages, high prices and food system instability.

The answer to the above questions is uncertain because we really do not know what changes will occur and to what extent. Nor do we know how well our society will anticipate and prepare for food system uncertainty and change. Predicting the future

from the past or the present is an uncertain enterprise. Who in 1900 would have predicted either the technological advances of the twentieth century or their irrational use in the mass destruction of people and the environment?

The only certainty is that change will occur and even if its nature and extent can not be accurately predicted, change must be anticipated and planned for. Also it is likely, considering recent history and present trends, that change in the near future will continue to be as dramatic and drastic as it has been in the recent past.

For example, the earth's atmosphere is undergoing an important transformation with the continual release into it of large quantities of carbon dioxide from deforestation and fossil fuel combustion. Certainly this development will have climatic impact, but the nature of that impact is uncertain. Some researchers predict that global temperature will rise altering precipitation patterns, producing drought in important agricultural areas while melting artic ice and raising sea levels. Other researchers discount this notion, predicting instead that plant life will flourish in the elevated levels of carbon dioxide.(131)

Such drastic disagreement between experts complicates the planning process. Similar disputes are common throughout the studies of different aspect of the food system. Dissension of this sort rather than demonstrating the futility of planning indicates the necessity of preparing for several possible

futures; it is not sufficient to merely assume in the face of uncertainty that the food system will just take care of itself.

While uncertainty about the future can not be eliminated, individually and collectively we can all prepare for it more effectively.

13.0 AGENDA FOR THE FUTURE

The first thing that must be on any future agenda for Montana's food system is more thorough research, analysis and diagnosis of the system's strengths and weaknesses.

Perhaps the most significant discovery of the present study was the lack of comprehensive research on Montana's complex food system. While some parts of the food system, such as agriculture, do receive careful attention, other parts of the system are totally neglected. Even the available information on agriculture is not usually related to the entire system. Any effective strategy for creating a more stable, sustainable food system must be based on a thorough understanding of how the food system operates.

Since this study is not the comprehensive analysis required, suggesting ways to improve the food system may seem contradictory in light of the above remarks. Nevertheless, there are some general recommendations which derive from the present study and from other research by the Cornucopia Project.

13.1 Suggestions For Consumers

No other part of the whole food system is so immediately responsive to individual and collective action as the home food system. Through careful selection of the foods they buy, by composting their garbage, by practicing increased energy conservancy and through a number of other innovative actions, consumers can tomorrow start to transform their part of the food system. The following suggestions are just a few of the many actions that could be adopted.

1. If you are concerned about the state of your food system, one of the first, and perhaps the best, things that you can do is to find other people that share your concern. Since the food system is an integrated whole made up of all of us, any individual action can be improved by group action. The essence of a sophisticated food system is cooperation on myriad levels; cooperation in strengthening the system is an appropriate and effective strategy. Most of the suggestions in the section can be adopted either individually or cooperatively.

2. Since effective action comes from knowledge, an important part of improving your part of the food system is to learn more about the food system in general and your part of it in particular. Some of the books used in this study and listed in the bibliography can help broaden your knowledge and many are available in public libraries. Other sources of information include magazines, newspapers and government agencies.

3. Another important part of becoming more active in your food system is to become more aware of what you eat and where it comes from. A shift from highly-processed food to fresh and/or local foods can improve both the food system and your health. A greater awareness of good nutrition and adopting healthy eating habits will result in lower food bills (since fresh foods are usually cheaper than processed foods as well as being more nutritious) and will improve the food system by reducing the purchase of highly processed foods.

4. Form a local Cornucopia Project consisting of people who want to work at changing some aspect of their food system. Possible activities include establishing home and community gardens, bartering, setting up food banks, cooperative food buying, storing and preserving.

5. Starting or expanding a home garden can save money and energy while providing food of incomparable freshness. In addition, many people find the act of gardening compensation itself. Gardeners can recycle their garbage by composting their organic residues rather than having them buried in a land fill. Composting will improve the quality of your soil and preserve valuable organic matter that would otherwise be wasted.

6. If you garden or plan to garden, seek out your County Extension agent for help and information. Other valuable sources of information include books on gardening many of which can be found in a library, and the practical experience of local gardeners and farmers.

7. Since your home food system accounts for at least 25 percent of your residential energy consumption, it is a good place to implement energy conservation. Study your kitchen to identify appliances that are high energy users and ways to decrease that usage. Try to plan your food purchases so that extra trips for one or two items can be avoided.

8. Purchase locally-grown fruits and vegetables in season, taking advantage of their peak nutritional value and decreased cost. Buying locally-grown food strengthens the local food system and the local economy. You can also process these foods yourself and store them for the cold weather months.

9. Become aware of changes in agricultural land usage in your area and support the appropriate use of prime agricultural lands for farming or community gardens.

10. Create a personal emergency supply of food. Temporary food shortages may result from many causes: national truckers' strike, oil embargo, severe weather, agricultural infestations or crop failures, geological events such as earthquakes and volcanoes. A one month food supply of basic foods can help you endure temporary food shortages and sudden price increases more easily.

13.2 Suggestions For Local Governments

1. Local governments should not leave all the decisions about the local food system in the hands of others. The first step to greater local control is to thoroughly study the unique characteristics of the local food system. The Missoula Planning Office performed such a study for the city and county of Missoula. Their report, Missoula County Agricultural Protection Study, represents an initial step

toward local understanding and control of the local food system.

2. Local governments can aid and encourage local food production and distribution by instituting a department to regulate and protect agricultural land use (to the extent that state law permits), encourage urban and rural food production, develop urban markets for local produce, initiate educational programs and create plans to meet normal and emergency local food needs through local production and storage.

3. Identify the long- and short-term costs before converting prime farmland to non-agricultural uses.

4. Establish community gardens particularly for low income residents. Seeds, tools and technical assistance on gardening could be made available to recipients of food stamps and other kinds of food assistance.

5. Aid the establishment of gardens and/or greenhouses in schools, hospitals and nursing homes.

6. Promote loan funds for food self-reliance projects, such as greenhouses and food preservation and storage operations.

7. Require garden areas in new multiple unit housing projects.

8. Incorporate composting operations in wastewater treatment plants.

9. Establish farmers' markets if they do not already exist or promote existing ones.

10. Encourage the establishment of local food banks to store and distribute surplus food.

11. Promote the purchase of food supplies by local institutions from local growers.

12. Develop emergency planning to cope with a food crisis where normal food supplies might be disrupted for one to four weeks or even longer.

13.3 Suggestions For State Government

1. Again, the first suggested action is that state government thoroughly study the state food system in a comprehensive manner, identifying the system's unique characteristics, its strengths and its weaknesses.

2. Promote greater crop diversification by offering incentives to farmers to diversify production, utilizing technical assistance from extension agents and low-interest state-guaranteed loans to make changes necessary for diversification.

3. Fund research by Montana State University into the potential of producing various crops needed in the state.

4. Establish demonstration experiments to test crop, animal and fish varieties suitable to our soil and climate as well as developing low-input sustainable farming techniques.

5. Monitor changes in agricultural lands more closely through additional funding to the Department of Agriculture and the Crop and Livestock Reporting Service.

6. Enforce and develop laws to discourage erosion. Link state assistance programs to avoidance of excessive soil erosion.

7. Promote the purchase of state agricultural products by state institutions.

8. Help establish more farmers' markets and aid the organizing of wholesale farmers' markets to supply retailers, consumer co-ops, and other volume purchasers.

9. Prepare a state-wide inventory of the types and amounts of organic wastes available now and in the future and assess the ability of these wastes to improve soil fertility and tilth and their potential energy use.

10. The state should plan appropriate actions for a variety of food emergencies.

11. Finally, the state should develop long-range food system plans which would emphasize increasing local self-reliance and economic viability while decreasing the vulnerability of the food system. In order to develop and implement such plans, the state should sponsor an annual study of the foods consumed in Montana: what kinds, what amounts, where they come from and how they are changing.

14.0 APPENDIX: FOOD CONSUMPTION IN MONTANA

One of the goals of this study was to compile an inventory of the different foods produced, imported and consumed in the state. Such information is necessary in order to have a clear understanding of Montana's food system and in order to answer some important food system questions: How much of the food consumed in the state is imported? What impact does this have on the transportation system? Are there foods presently being imported that could instead be produced in the state, eliminating long-distance transportation and bolstering local economies? How much would the state's food system be disrupted by a disruption of the national transportation system or of production in other states?

These are just a few of the important questions concerning the food system that a food consumption inventory could help answer. Unfortunately, such an inventory has not been done in the past, and this study was unable to produce a comprehensive inventory.

One problem that makes a state food inventory difficult is that nobody knows how much of each type of food is consumed in the state. While there are national per capita consumption figures for a wide variety of foods, there is good reason to believe that Montana consumption patterns often deviate from the national average. For example, this study found that with fresh fruits and vegetables the importation into the state was usually less than predicted consumption.

Table 1 lists pounds of production, consumption and importation of fresh fruits and vegetables for 1980. The consumption figures were computed by multiplying national per capita consumption for each food by Montana's population in 1980. The importation figures are computed from figures gathered by the Plant Industry Division of the Montana Department of Agriculture which compiles a monthly "Summary of Fruits and Vegetables Inspected and Used in Montana Markets..." These figures come from licensed produce wholesalers. The statistics are broken down into two categories: imported and homegrown.

Table 2 shows Montana's production and consumption of meat, poultry and fish. These statistics should be read with a certain amount of caution. At first glance it seems that Montana ranchers produce cattle with a retail weight seven times greater than state consumption of beef. But most Montana beef is not processed in state.

Table 3, Montana Production and Consumption of Dairy Products, would seem to indicate that Montana was importing milk to meet consumption requirements. But milk is also exported. In 1980, fifteen million pounds of Grade "A" milk were imported into the state while 35 million pounds were exported.

Table 4 shows the production and consumption of grains and legumes in Montana. Although it would appear that Montana farmers are raising far more corn, barley, oats and wheat than are being consumed in-state, again figures are somewhat misleading. It is not known how much of Montana's grain production

is being fed to livestock, or how much grain is shipped out-of-state for processing and imported into Montana in the form of flours, cereals and baked goods. Therefore, the production figures can give only an indication of Montana's capability to produce grains for in-state consumption.

One of the purposes of a food inventory is to compute how much food is imported into the state. Because much of the information needed for this calculation is not available, only a rough estimate can be made.

Montana produces approximately twenty commodities for which production statistics are collected. Beef, lamb, creamed and cottage cheeses, sweet cherries, barley, corn, oats, dry beans, sugar beets and honey are raised in sufficient quantities to be exported. In these eleven commodities then, Montana has the capability to be self-sufficient.

But Montanans consume a wide variety of fresh, frozen, and canned fruits, vegetables and dairy products that are not produced in Montana, or are produced in such small quantities that no records are kept. Based on the statistics that are available, it would seem that about 60 percent of the food consumed in Montana is imported. This estimate may be low, since some of the commodities Montana produces are sent outside the state for processing.

Another purpose of a food inventory is to demonstrate the potential markets for increased production of a wider range of agricultural products within the state. It is difficult to predict how much more of the foods consumed in Montana could be produced in the state. Certainly Montana has abundant agricultural land. But a diversified production would require irrigation. Yet the opportunity exists particularly for increased state production of fresh fruits and vegetables.

	Production		Consumption		Importation	
	weight 10001b	value $1000	weight 10001b	value $1000	weight 10001b	value $1000
Vegetables						
Artichokes	nc		236.10	286.72	105.04	127.10
Asparagus	nc		236.10		141.78	
Broccoli	nc		1337.90	923.15	891.45	615.10
Cabbage	45.35	12.70	6610.80	1851.02	3173.50	888.60
Carrots	3.55	1.14	4800.70	1536.22	2375.50	760.20
Cauliflower	0.97	0.84	1023.10	890.10	997.00	867.39
Celery	nc		5745.10	1322.76	6115.68	2079.00
Cucumbers	3.16	1.33	3148.00	1070.32	1746.40	733.50
Eggplant	nc		393.50	306.93	154.90	120.80
Green peppers	nc		2597.10	1895.88	1661.50	1212.90
Lettuce	4.60		19596.30	6858.70	14821.30	5187.50
Mushrooms	nc		9286.60	16808.75	629.00	1138.50
Onions	nc		8027.40	2087.12	5999.60	1559.90
Potatoes	10266.60	2361.30	38799.10	8923.79	25979.90	5975.40
Snap bean	3.44	2.48	1023.10	736.63	161.90	116.60
Squash	48.10	22.60	nc		2490.30	1170.40
Sweet Corn	nc		5194.20	1766.03		
Sweet potatoes	nc		2675.80	1632.23	654.04	399.00
Tomatoes			8971.80	5293.36	7430.70	4384.10
Fresh Fruits						
Apples	638.32	389.40	12592.00	7681.12	9980.00	6087.00
Bananas			16369.60	5401.97		
Cherries	1400.00	1204.00	472.20	407.04	344.30	296.80
Grapefruit			6138.60	886.41	3333.70	1267.00
Lemon/lime			1810.10	1013.67	1085.70	607.60
Oranges/tangerines			13929.90	5850.56	10623.20	4461.70
Grapes			2833.20	2634.88	2930.70	2725.50
Melons			13300.30	5719.13	2885.60	1212.00
Peaches/nectarines			5509.00	3140.13	785.40	447.70
Pears			1888.80	406.65	1200.30	522.10
Plums			1180.50	1027.04	722.30	626.40
Vegetables, Processed						
Asparagus, frozen			47.22	161.02		
Asparagus, canned			236.10	462.76		
Beets, canned			944.40	387.20		
Broccoli, frozen			1101.80	1189.94		
Brussel sprouts, frozen			196.75	192.82		
Carrots, frozen			731.91	468.42		
Carrots, canned			393.50	184.94		
Cauliflower, frozen			362.02	148.43		
Corn, frozen			1518.91	1139.18		
Corn, canned			4564.60	2008.42		
Lima beans, frozen			369.89			
Lima beans, canned			236.10			
Onions, dehydrated			2046.20			
Onions, frozen			535.16			
Peas, frozen			1211.98	787.79		
Peas, canned			2597.10	1142.72		
Pickles, canned			5430.30	2497.94		
Potatoes, frozen			17864.90			
Potatoes, canned			1023.10	491.09		
Pumpkin and squash, canned			314.80	229.80		
Saurkraut			944.40	377.76		
Snap beans, frozen			787.00	550.90		
Snap beans, canned			4879.40	2488.49		
Spinach, frozen			590.25	330.54		
Spinach, canned			393.50	181.01		
Sweet potatoes			787.00	432.85		
Tomatoes, canned whole			4800.70	1920.28		
Tomatoes, pulp and puree			629.60	151.10		
Catsup, paste, sauce, canned			9522.70	4316.96		
Tomato and vegetable juice			2518.40	629.60		
Other, canned			708.30			
Fruits, Processed						
Fruits, frozen			2179.99			
Citrus juices, frozen			7791.30	9474.22		
Fruits, canned and chilled			13693.80	5944.94		
Fruit juice, canned			18203.31			
Fruits, dried			2313.78	3100.46		

NC - Not Collected

Table 2

Montana Production and Consumption of Meats, Poultry Products, and Fish

Commodity	1980 Production (1,000 lbs.)	1980 Consumption (1,000 lbs.)
Meats		
Beef	434,978.88	60,205.50
veal	NC	1,180.50
Lamb & Mutton	12,756.30	1,023.10
Pork	49,858.25	53,752.10
Poultry		
Chicken	1,051.00	39,350.00
Turkey	NC	8,263.50
Eggs	2,219.44	14,704.31
Fish	242.16	24,937.25

Table 3:

Montana Production and Consumption of Dairy Products

Commodity	1980 Production (1,000 lbs.)	1980 Consumption (1,000 lbs.)
Butter	1,938.00	3,462.80
Cheese		
Hard	8,762.53	13,851.20
Cottage & Creamed	5,200.00	3,541.50
Evaporated & Condensed Milk	NC	5,902.50
Fluid Milk & Cream	193,198.79	196,750.00
Frozen Dairy Products	13,986.00	20,698.10
Dry Milk Products	NC	5,351.60

Table 4:

Montana Production and Consumption of Grains and Legumes

Commodity	1980 Production (1,000 lbs.)	1980 Consumption (1,000 lbs.)
Barley	2,116,800.00	1,333.97
Corn	33,152.00	17,391.02
Oats	70,670.42	4,220.68
Rye	NC	482.04
Wheat	6,396,000.00	129,690.31
Dry edible beans	17,600.00	2,881.05
Dry field peas	NC	121.89

15.0 FOOTNOTES

1. The Cornucopia Project is sponsoring studies similar to this one of every state in the U.S. A study of the nation's food system, Empty Breadbasket, has been completed and is available.

2. U.S. Department of Commerce, Statistical Abstract of the United States 1981, (Washington, D.C.: Government Printing Office 1982), p. 424. About $302.9 billion was expended on food in 1980, or $1,330 per capita.
$1,330 x 787,000 = $1.0467 billion

3. U.S. Department of Agriculture, Leading Indicators of the Farm Sector, (Washington, D.C. 1980), p.159.

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6. U.S. Department of Energy, Agriculture and Food Processes Branch Program Summary Document, (Washington, D.C. 1980), p. 1.

7. General Accounting Office, Food, Agriculture and Nutrition Issues for Planning, (Gaithersburg, MD, 1982), p. 10.

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9. IBID, p. 8

10. K. Ross Toole, The Rape of the Great Plains, (Boston, 1976), p. 23.

11. Merrill G. Burlingame, The Montana Frontier, (Helena, MT: State Publishing Co., 1942), p. 284.

12. K. Ross Toole, Twentieth Century Montana, (Norman, OK: University of Oklahoma Press, 1972), p. 26.

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acres. Apparently there is grazing land that is included in the first figure but not in the second.

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16. Montana Agricultural Statistics 1982, p. 9.

17. Phone converstations on 8-27-82 and 8-25-82 with Gordon Watson, Montana coordinator of National Resources Inventory.

18. Department of Natural Resources, Conservation Districts Division, Resource Conservation Plan 1981-1985, (Helena, MT 1981), p. 15.

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U.S. Department of Agriculture, 1980 Appraisal Part I: Soil, Water, and Related resources in the United States: Status, Conditions and Trends, (Washington, D.C.: GPO 1981)

20. U.S. Department of Agriculture, Soil Conservation Service, Montana Multi-year Plan for Resource Conservation, (Bozeman, MT 1982), p. 3.

21. USDA, 1980 Appraisal, Part I, p. 99.

22. IBID, pp. 82, 84.

23. IBID

24. Resource Conservation Plan, p. 17.

25. IBID, p. 7 and U.S. Department of Agriculture Conservation Service, Basic Statistics 1977 National Resources Inventory, rev. 1980 (Washington, D.C.:Soil Conservation Service, 1980), Tables 16 and 17.

26. IBID

27. Jennifer Bennet, "Reap the Wild Wind", Harrowsmith, June/July 1982, pp. 61, 63.

28. Eko-kompost of Missoula sells compost for about $60 a ton. Using USDA figures, at least 67 million tons of soil were carried away by erosion on Montana agricultural land in 1977. The lower dollar figure is the result of the bold assumption that per unit costs for compost would be cut in half by manufacturing such large amounts.

29. Resource Conservation Plan, p. 22

30. IBID

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35. IBID

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75. Richard Stroup and Thomas Miller, Feasibility of Ethanol from Grain in Montana, (Bozeman, MT: 1978), p. 1

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89. "State of the Food Industry", Food Engineering, p. 73.

90. Jim Hightower, Eat Your Heart Out, (New York, Crown Publishers, Inc: 1975), p. 11

91. Ingolf Vogeler, The Myth of the Family Farm, p. 7

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93. $1,330 per capita x 787,000 = $1.0467 billion.

94. Compiled from County Business Patterns 1980, pp. 6, 7

95. "49th Annual Report of the Grocery Industry", Progressive Grocer, vol. 61, no. 4, April 1982, p. 51

96. IBID, p. 57

97. IBID, p. 112

98. IBID, p. 114

99. Robert Emerson, Fast Food, (New York, Lebhar-Friedman Books: 1979), Table 2-1, p. 12

100. IBID, pp. 5, 47

101. U.S. Department of Commerce, Statistical Abstract of the United States 1981, (Washington, D.C.: Government Printing Office 1982), p. 819

102. Robert Emerson, p. 283

103. Norman Myers, "The Hamburger Connection: How Central America's Forests Become North America's Hamburgers", Ambio, vol. 10, no. 1

104. Statistical Abstract of the United States 1981, pp. 751, 753. Residential construction in Montana was worth $205 million in 1980 ($205 million x .10 = $20.5 million). Residential construction in the United States was $87,261 million in 1980 ($87,261 million x .10 = $8,726 million). A figure of 10 percent of housing costs being related to the food system was suggested by Steinhart and Steinhart, p. 309.

105. The retail value of major kitchen appliances shipped in 1980 was $8.102 billion (Statistical Abstract of the United States, 1981) or $35.69 per capita. $35 x 787,000 = $28 million.

106. The retail value of small electric kitchen appliances shipped in 1980 was $1.874 billion or $8.25 per capita.

107. The food system consumes at least 17 percent of all energy used in the United States, and the home food system uses 27 percent of food system energy or 4.59 percent of total energy use. (1979 Handbook of Agricultural Charts, p. 34) "The 75 million households in the U.S. consume more than one-fifth of the nation's total energy.." [Eric Hine, Richard Goeltz and Janet Carney, Residential Energy Use and Conservation Activities..., (Oak Ridge, TN: 1981), p. 1] So .05/.20 = .25.

108. Lynda Steele, Historical Energy Statistics, (Helena, MT: 1980)

109. Montana had 284,000 households in 1980 (Statistical Abstract of the United States 1981, p. 44). Twenty-nine percent of households in the West had gardens in 1980 (The Gallup Organization, National Gardening Survey 1980-81, [Burlington, VT: Gardens for All, 1980], p. 11). The average yield per garden was 588 pounds of produce worth $441 (p. 29). The average expenditure per gardener was $50 (p. 63), and the average garden size was 663 square feet (p. 11).

1. 284,000 households x .29 = 82,360 gardens
2. 588 pounds/garden x 82,360 gardens = 48.428 million pounds
3. $441/garden x 82,360 gardens = $36.32 million
4. $50 expenditure/garden x 82,360 gardens = $4.118 million
5. 663 square feet/garden x 82,360 gardens = 54.605 million sq.ft.
6. 54,605,000 sq.ft./43,560 sq.ft. per acre = 1254 acres

110. About 26 percent of food expenditures are for meals consumed away from home. (U.S. Department of Agriculture, Food Consumption, Prices and Expenditure 1960-80, p. 98, Table 87) $1 billion x .74 = $740 million

111.

1. $ 20 million on kitchen construction
2. $ 33 million on appliances
3. $ 37 million for residential energy
4. $ 4 million for garden supplies
5. $740 million for food
6. $834 million total home food system expenditures

112. 1980 Appraisal, Part I, p. 268

113. 1980 Appraisal, PartII, p. 182

114. Donald L. Van Dyne and Conrad B. Gilbertson, Estimating U.S. Livestock and Poultry Manure and Nutrient Production, (1978), p. 9

115. 1980 Appraisal, Part II, p. 182

116. Phone conversation with Dr. Joseph Horvath of Eko-kompost

117. Steinhart and Steinhart, p. 308

118. 1980 Appraisal, PartII, p. 182.

119. Agriculture and Food Processes Branch Program Summary Document, p. 56

120. Personal communication, September 8, 1982, from Dave Lewis, Director Ofice of Budget and Program Planning

121. Statistical Abstract of the United States 1981, p. 129

122. 49th Annual Report of the Grocery Industry, p. 116

123. Phone conversation with Bris Skiles, Office of Public Instruction, August 13, 1982.

124. Mary Painter, "Poor Children: The Big Losers Under Reagonomics", Food Monitor, July/August 1982, pp. 23, 24

125. George F. Will, "The South Carolina Hybrid", Newsweek, December 20, 1982, p. 92

126. Personal communication on September 17, 1982 from Mary Ellen Holberson, Nutrition Coordinator Health Services Division of Health and Environmental Sciences.

127. Food, Agriculture and Nutrition Issues for Planning, p. 58

128. Montana Agricultural Statistics 1982, p. 10

129. Steinhart and Steinhart, p. 311

130. Food, Agriculture and Nutrition Issues for Planning

131. Two recent articles representing the two sides of the debate are: Roger Revelle, "Carbon Dioxide and World Climate", Scientific American, vol.247, no.2, August 1982
Sylvan H. Wittwer, "Carbon Dioxide and Crop Productivity", New Scientist, vol.95, no.1315, July 22, 1982

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Water Resources Division; Issues in Water Management, Department of Natural Resources and Conservation, Helena, MT., 1981.

Water Resources Division; How the River Runs, a Study of Potential Changes in the Yellowstone River Basin, Montana Department of Natural Resources and Conservation, Helena, MT., 1981.

Montana Food System Organizations

There are many organizations which directly or indirectly are working toward developing a sustainable food system in Montana. The following is a selected list of organizations working with consumers, farmers, and the food industry in Montana.

Montana Farm Bureau
1505 S. Wilson Ave.
Bozeman, MT 59715

Big Sky Farmers and Ranchers
Marketing Cooperative
1127 Smelter Ave.
Black Eagle, MT 59414
(406) 452-2083

Montana Department of Agriculture
1300 Cedar
Helena, MT 59601
(406) 449-3144

Bear Paw Farmers and Ranchers
Marketing Cooperative
1108 15th Ave. S.W.
Great Falls, MT 59401
(406) 453-9625

Montana Farmers' Union
750 Sixth Aven. S.W.
Great Fall, MT 59401
(406) 452-6406

Farmers Home Administration
4930 Ninth Ave. South
Great Falls, MT 59405
(406) 454-3446

The Montana Land Reliance
P.O. Box 355
Helena, MT 59601

Norhern Plains Resource Council
419 Stapleton Building
Billings, MT 59101
(406) 248-1154

Western SUN
J. Lee Cook
Energy Division, DNRC
32 S. Ewing
Helena, MT 59601
(406) 449-4624

Heron Food & Garden Co-op
General Delivery
Heron 59844
Judy Hutchins
In operation since: 1976

Prickly Pear, Inc.
P.O. Box 422
Helena 59601
Judith Johnston
In operation since: Aug. 1979

The Flathead Valley Food &
Garden Cooperative, Inc.
P.O. Box 1497
Kalispell 59901
Mary Miller
In operation since: March 1979

Malta Co-op
P.O. Box 322
Malta 59538
Sioux Surbrugg
In operation since: Dec. 1979

Lower Flathead Co-op
P.O. Box 297
St. Ignatius 59865
Viki Albright, John Walker,
David Munson-Young
In operation since: Jan: 1979

Sapphire Mountain Co-op
Route 3, Box 1312
Stevensville 59870
Peter & Jean Lethenstrom
In operation since: 1975

Swamp Creek Community Grits
P.O. Box 414
Thompson Falls 59873
Coordinatorship rotates monthly
In operation since: Aug. 1978

Copper City Food Co-op
730 W. Broadway
Butte 59701
Dick Ward
In operation since: 1978

The New Frontier Food Co-op
124 N. 18
Billings 59101
Sandra Bennett
In operation: 2½ years

Crossroads Food Center
325 S. Wallace
Bozeman 59715
Manager and 7 member board
In operation since: May 1979

Bitterroot Food Co-op
Tin Cup Road
Darby 59829
Mary Frechette
In operation since: 1974

Tobacco Valley Co-op
P.O. Box 857
Eureka 59917
Sue Llewellyn
In operation since: 1977

Our Treasures State Food Co-op
Opportunities, Inc.
607 11 N.
Great Falls 59403
Bill Magee
In opeation since: 1979